MULTI-INSTRUMENT IONOSPHERIC DISTURBANCE DETECTION OVER THE EASTERN MEDITERRANEAN REGION

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1. INTRODUCTION

This paper presents examples of a multi-instrument approach in ionospheric disturbance detection over the Eastern Mediterranean region. The results presented are based on a scientific initiative to establish an ionospheric monitoring network over Cyprus and Egypt by linking the corresponding instruments in operation in the two countries: a group of three Coherent Ionospheric Doppler Receiver (CIDR) systems being deployed in a roughly north-south chain in Egypt and a modern digital DPS-4D ionosonde (digisonde) collocated with a dual-frequency GNSS receiver in Cyprus. The CIDR and DPS-4D instruments considered in this paper have been recently installed in an effort to initiate ionospheric research in the two countries. The cooperation in the frames of this project is considered very beneficial especially taking into account the fact that both countries lack important infrastructure and a tradition of ionospheric observations.

1. INSTRUMENTATION

The CIDR systems provide TEC (Total electron content) measurements by tracking LEO beacons at 150 and 400 MHz at higher data rate than GPS signals allowing measurements of rapid ionospheric variations. They are expected to provide routine observations of the equatorial fountain peaks and to enable their tomographic reconstruction. The DPS-4D is the latest digital ionosonde by the University of Massachusetts Lowell's Center for Atmospheric Research (UMLCAR) capable of performing fast ionograms and improved layer height variation measurements by taking advantage of the Precision Group Height Measurement technique (Figure 1).

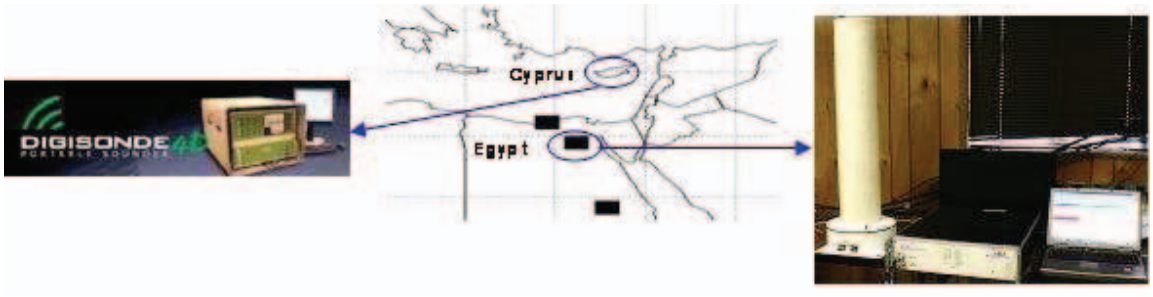
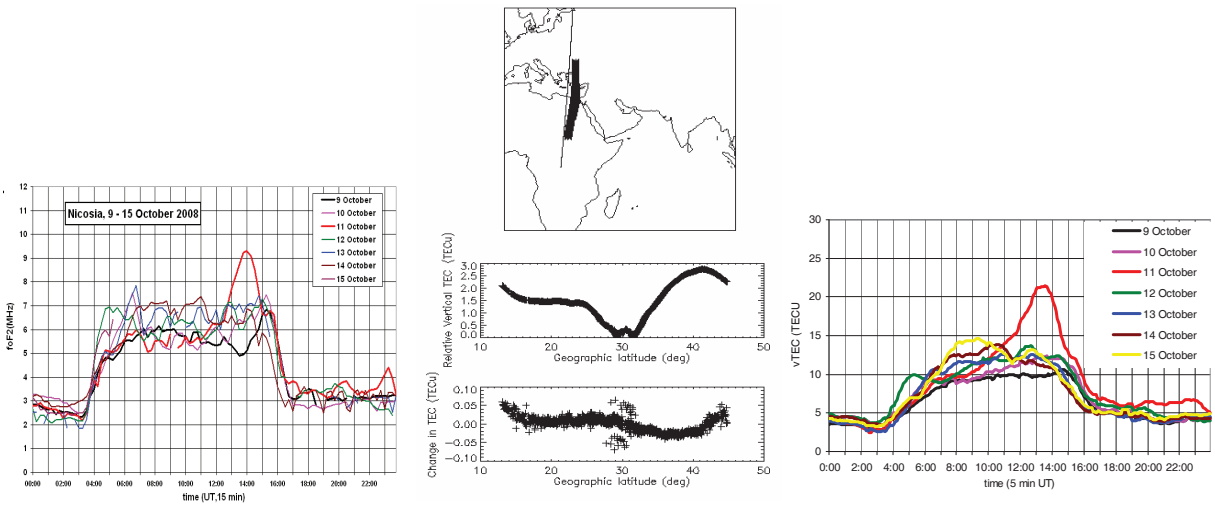


Figure 1: CIDR systems in Egypt and DPS-4D ionosonde (digisonde) in Cyprus.

2. IONOSPHERIC DISTURBANCE DETECTION CASES

A number of disturbance cases will be presented by making use of all three types of measurements [1],[2],[3] (Figure 2) demonstrating the ability of the instrument network to capture the spatial and temporal variation of these disturbances over a significant latitudinal extent also enhancing the knowledge on the coupling mechanisms between mid-latitude and low-latitude ionosphere.



(a) (b) (c)

Figure 2: Plots of (a) digisonde derived F2-layer critical frequency, (b) CIDR derived vTEC (vertical Total Electron Content) and (c) GPS derived vTEC over the Eastern Mediterranean region during a geomagnetic storm.

3. CONCLUSIONS

The Cyprus digisonde and three Coherent Ionospheric Doppler Receiver (CIDR) systems are in the position to fulfill their research purpose to a greater extent by forming a wider network than by working in isolation. The network over the two countries due to its significant latitudinal extent will provide the opportunity for a coordinated experimental investigation of the formation and evolution of large and small scale plasma density irregularities and will provide the unique occasion to study coupling of equatorial and mid-latitude ionosphere for improved physical understanding and prediction of these phenomena over the Eastern Mediterranean region.

4. REFERENCES

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